

**DIAGNOSTIC/MASTER EXAM: AP BIOLOGY****Time—45 minutes**

For the following multiple-choice questions, select the best answer choice and fill in the appropriate oval on the answer grid.

1. A pH of 10 is how many times more basic than a pH of 7?
    - A. 2
    - B. 10
    - C. 100
    - D. 1,000
    - E. 10,000
  2. A reaction that breaks down compounds by the addition of water is known as
    - A. a hydrolysis reaction.
    - B. a dehydration reaction.
    - C. an endergonic reaction.
    - D. an exergonic reaction.
    - E. a redox reaction.
  3. Which of the following is not a lipid?
    - A. Steroid
    - B. Fat
    - C. Phospholipid
    - D. Glycogen
    - E. Cholesterol
  4. A compound contains a COOH group. What functional group is that?
    - A. Amino group
    - B. Carbonyl group
    - C. Carboxyl group
    - D. Hydroxyl group
    - E. Phosphate group
  5. The presence of which of the following organelles or structures would most convincingly indicate that a cell is a eukaryote and not a prokaryote?
    - A. Plasma membrane
    - B. Cell wall
    - C. Nucleoid
    - D. Lysosome
    - E. Ribosome
  6. Destruction of microfilaments would most adversely affect which of the following?
    - A. Cell division
    - B. Cilia
    - C. Flagella
    - D. Muscular contraction
    - E. Chitin
  7. Which of the following forms of cell transport requires the input of energy?
    - A. Diffusion
    - B. Osmosis
    - C. Facilitated diffusion
    - D. Movement of a solute down its concentration gradient
    - E. Active transport
  8. Among the following choices, which one would most readily move through a selectively permeable membrane?
    - A. Small, uncharged polar molecule
    - B. Protein hormone
    - C. Large, uncharged polar molecule
    - D. Glucose
    - E. Sodium ion
- For questions 9–12, please use the following answers:
- A. Glycolysis
  - B. Krebs cycle
  - C. Oxidative phosphorylation
  - D. Chemiosmosis
  - E. Fermentation
9. This reaction occurs in the mitochondria and involves the formation of ATP from NADH and FADH<sub>2</sub>.
  10. The coupling of the movement of electrons down the electron transport chain with the formation of ATP using the driving force provided by the proton gradient.

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11. This reaction occurs in the cytoplasm and has as its products 2 ATP, 2 NADH, and 2-pyruvate.
12. This reaction is performed by cells in an effort to regenerate the  $\text{NAD}^+$  required for glycolysis to continue.
13. Which of the following is a specialized feature of plants that live in hot and dry regions?
  - A. Stomata that open and close
  - B. Transpiration
  - C. Photophosphorylation
  - D.  $\text{C}_4$  photosynthesis
  - E. Carbon fixation
14. The light-dependent reactions of photosynthesis occur in the
  - A. nucleus.
  - B. cytoplasm.
  - C. mitochondria.
  - D. thylakoid membrane.
  - E. stroma.
15. The oxygen produced during the light reactions of photosynthesis comes directly from
  - A.  $\text{H}_2\text{O}$ .
  - B.  $\text{H}_2\text{O}_2$ .
  - C.  $\text{C}_2\text{H}_3\text{O}_2$ .
  - D.  $\text{CO}_2$ .
  - E. CO.
16. The cyclic pathway of photosynthesis occurs because
  - A. the chloroplasts need to regenerate  $\text{NAD}^+$ .
  - B. the Calvin cycle uses more ATP than NADPH.
  - C. it can occur in regions lacking light.
  - D. it is a more efficient way to produce oxygen.
  - E. it is a more efficient way to produce the NADPH needed for the Calvin cycle.
17. Which of the following statements about mitosis is correct?
  - A. Mitosis makes up 30 percent of the cell cycle.
  - B. The order of mitosis is prophase, anaphase, metaphase, telophase.
  - C. Single-cell eukaryotes undergo mitosis as part of asexual reproduction.
  - D. Mitosis is performed by prokaryotic cells.
  - E. Cell plates are formed in animal cells during mitosis.
18. An organism that alternates between a haploid and a diploid multicellular stage during its life cycle is most probably a
  - A. shark.
  - B. human.
  - C. whale.
  - D. pine tree.
  - E. amoeba.
19. Homologous chromosomes are chromosomes that
  - A. are found only in identical twins.
  - B. are formed during mitosis.
  - C. split apart during meiosis II.
  - D. resemble one another in shape, size, and function.
  - E. determine the sex of an organism.
20. Crossover occurs during
  - A. prophase of mitosis.
  - B. prophase I of meiosis.
  - C. prophase II of meiosis.
  - D. prophase I and II of meiosis.
  - E. all the above.
21. Which of the following conditions is an X-linked condition?
  - A. Hemophilia
  - B. Tay-Sachs disease
  - C. Huntington's disease
  - D. Cystic fibrosis
  - E. Sickle cell anemia
22. In hypercholesterolemia, a genetic condition found in humans, individuals who are HH have normal cholesterol levels, those who are hh have horrifically high cholesterol levels, and those who are Hh have cholesterol levels that are somewhere in between. This is an example of
  - A. dominance.
  - B. incomplete dominance.
  - C. codominance.
  - D. pleiotropy.
  - E. epistasis.



23. The situation in which a gene at one locus alters the phenotypic expression of a gene at another locus is known as
- dominance.
  - incomplete dominance.
  - codominance.
  - pleiotropy.
  - epistasis.
24. Which of the following is an example of aneuploidy?
- Cri-du-chat syndrome
  - Chronic myelogenous leukemia
  - Turner syndrome
  - Achondroplasia
  - Phenylketonuria
25. Which of the following is an incorrect statement about DNA replication?
- It occurs in the nucleus.
  - It occurs in a semiconservative fashion.
  - Helicase is the enzyme that adds the nucleotides to the growing strand.
  - DNA polymerase can build only in a 5'-to-3' direction.
  - It occurs during the S phase of the cell cycle.
26. A virus that carries the reverse transcriptase enzyme is
- a retrovirus.
  - a prion.
  - a viroid.
  - a DNA virus.
  - a plasmid.
27. The uptake of foreign DNA from the surrounding environment is known as
- generalized transduction.
  - specialized transduction.
  - conjugation.
  - transformation.
  - crossover.
28. The process by which a huge amount of DNA is created from a small amount of DNA in a very short amount of time is known as
- cloning.
  - transformation.
  - polymerase chain reaction.
  - gel electrophoresis.
  - generalized transduction.
29. In a large pond that consists of long-finned fish and short-finned fish, a tornado wreaks havoc on the pond, killing 50 percent of the fish population. By chance, most of the fish killed were short-finned varieties, and in the subsequent generation there were fewer fish with short fins. This is an example of
- gene flow.
  - natural selection.
  - bottleneck.
  - balanced polymorphism.
  - allopatric speciation.
30. Imagine that for a particular species of moth, females are primed to respond to two types of male mating calls. Males who produce an in-between version will not succeed at obtaining a mate and will therefore have low reproductive success. This is an example of
- directional selection.
  - stabilizing selection.
  - artificial selection.
  - honest indicators.
  - disruptive selection.
31. Traits that are similar between organisms that arose from a common ancestor are known as
- convergent characters.
  - homologous characters.
  - vestigial characters.
  - stabilizing characters.
  - divergent characters.
32. Imagine that 9 percent of a population of anteaters have a short snout (recessive), while 91 percent have a long snout (dominant). If this population is in Hardy-Weinberg equilibrium, what is the expected frequency (in percent) of the heterozygous condition?
- 26.0
  - 30.0
  - 34.0
  - 38.0
  - 42.0

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33. Which of the following is the *least* specific taxonomic classification category?
- A. Class
  - B. Division
  - C. Order
  - D. Family
  - E. Genus
34. Which of the following is not a characteristic of bryophytes?
- A. They were the first land plants.
  - B. They contain a waxy cuticle to protect against water loss.
  - C. They package their gametes into gametangia.
  - D. They do not contain xylem.
  - E. The dominant generation is the sporophyte.
35. Halophiles would be classified into which major kingdom?
- A. Monera
  - B. Protista
  - C. Plantae
  - D. Fungi
  - E. Animalia
36. Plants that produce a single spore type that gives rise to bisexual gametophytes are called
- A. heterosporous.
  - B. tracheophytes.
  - C. gymnosperms.
  - D. homosporous.
  - E. angiosperms.
37. A vine that wraps around the trunk of a tree is displaying the concept known as
- A. photoperiodism.
  - B. thigmotropism.
  - C. gravitropism.
  - D. phototropism.
  - E. transpiration.
38. These cells control the opening and closing of a plant's stomata:
- A. Guard cells
  - B. Collenchyma cells
  - C. Parenchyma cells
  - D. Mesophyll cells
  - E. Sclerenchyma cells
39. You have just come back from visiting the redwood forests in California and were amazed at how *wide* those trees were. What process is responsible for the increase in width of these trees?
- A. Growth of guard cells
  - B. Growth of collenchyma cells
  - C. Growth of apical meristem cells
  - D. Growth of lateral meristem cells
  - E. Growth of tracheid cells
40. This hormone is known for assisting in the closing of the stomata, and inhibition of cell growth.
- A. Absciscic acid
  - B. Auxin
  - C. Cytokinin
  - D. Ethylene
  - E. Gibberellin
41. In which of the following structures would one most likely find smooth muscle?
- A. Biceps muscle
  - B. Heart
  - C. Digestive tract
  - D. Quadriceps muscle
  - E. Gluteus maximus muscle
42. Which of the following hormones is *not* released by the anterior pituitary gland?
- A. Follicle-stimulating hormone (FSH)
  - B. Antidiuretic hormone (ADH)
  - C. Growth hormone (GH or STH)
  - D. Adrenocorticotrophic hormone (ACTH)
  - E. Luteinizing hormone (LH)
43. Most of the digestion of food occurs in the
- A. mouth.
  - B. esophagus.
  - C. stomach.
  - D. small intestine.
  - E. large intestine.



44. Antigen invader → B-cell meets antigen → B-cell differentiates into plasma cells and memory cells → plasma cells produce antibodies → antibodies eliminate antigen. The preceding sequence of events is a description of
- cell-mediated immunity.
  - humoral immunity.
  - nonspecific immunity.
  - phagocytosis.
  - cytotoxic T-cell maturation.
45. In humans, spermatogenesis, the process of male gamete formation, occurs in the
- interstitial cells.
  - seminiferous tubules.
  - epididymis.
  - vas deferens.
  - seminal vesicles.
46. The trophoblast formed during the early stages of human embryology eventually develops into the
- placenta.
  - embryo.
  - epiblast.
  - hypoblast.
  - morula.
47. Which of the following structures would not have developed from the mesoderm?
- Muscle
  - Heart
  - Kidneys
  - Bones
  - Liver
48. In humans, the developing embryo tends to attach to this structure.
- Fallopian tube
  - Oviduct
  - Endometrium
  - Cervix
  - Ovary
- For questions 49–52, please use the following answer choices:
- Associative learning
  - Insight learning
  - Optimal foraging
  - Imprinting
  - Altruistic behavior
49. The ability to reason through a problem the first time through with no prior experience.
50. Action in which an organism helps another, even if it comes at its own expense.
51. Process by which an animal substitutes one stimulus for another to get the same response.
52. Innate behavior learned during a critical period early in life.
53. Warning coloration adopted by animals that possess a chemical defense mechanism is known as
- cryptic coloration.
  - deceptive markings.
  - aposemetric coloration.
  - batesian mimicry.
  - müllerian mimicry.
54. Ants live on acacia trees and are able to feast on the sugar produced by the trees. The tree is protected by the ants' attack on any foreign insects that may harm the tree. This is an example of
- parasitism.
  - commensualism.
  - mutualism.
  - symbiosis.
  - competition.
55. What biome is known for having the greatest diversity of species?
- Taiga
  - Temperate grasslands
  - Tropical forest
  - Savanna
  - Deciduous forest
56. Which of the following is a characteristic of an R-selected strategist?
- Low reproductive rate
  - Extensive postnatal care
  - Relatively constant population size
  - J-shaped growth curve
  - Members include humans

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For questions 57–60, please use the information from the following laboratory experiment:

You are working as a summer intern at the local university laboratory, and a lab technician comes into your room, throws a few graphs and tables at you, and mutters, “Interpret this data for me . . . I need to go play golf. I’ll be back this afternoon for your report.” Analyze the data this technician so kindly gave to you, and use it to answer questions 57–60. The reaction rates reported in the tables are relative to the original rate of the reaction in the absence of the

enzymes. The three enzymes used are all being added to the same reactants to determine which should be used in the future.

**Room Temperature (25°C), pH 7**

ENZYME	REACTION RATE
1	1.24
2	1.51
3	1.33

**Varying Temperature, Constant (pH 7)**

ENZYME	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C
1	1.00	1.02	1.04	1.19	1.20	1.24	1.29	1.27	1.22
2	1.01	1.12	1.35	1.39	1.65	1.51	1.40	1.12	1.01
3	1.06	1.21	1.55	1.44	1.35	1.33	1.15	1.10	1.06

**Varying pH, Constant Temperature = 25°C**

ENZYME	4	5	6	7	8	9	10
1	1.54	1.51	1.33	1.24	1.20	1.08	1.05
2	1.75	1.71	1.62	1.51	1.32	1.10	1.01
3	1.52	1.45	1.40	1.33	1.20	1.09	1.04

57. If you had also been given a graph that plotted the moles of product produced versus time, what would have been the best way to calculate the rate for the reaction?

- A. Calculate the average of the slope of the curve for the first and last minute of reaction.
- B. Calculate the slope of the curve for the portion of the curve that is constant.
- C. Calculate the slope of the curve for the portion where the slope begins to flatten out.
- D. Add up the total number of moles produced during each time interval and divide by the total number of time intervals measured.
- E. The rate of reaction cannot be determined from the graph.

58. Over the interval measured, at what temperature does enzyme 2 appear to have its optimal efficiency?

- A. 10°C
- B. 15°C
- C. 20°C
- D. 25°C
- E. 30°C



59. Which of the following statements about enzyme 3 is incorrect?
- A. At a pH of 6 and a temperature of 25°C, it is more efficient than enzyme 2 but less efficient than enzyme 1.
  - B. It functions more efficiently in the acidic pH range than the basic pH range.
  - C. At 30°C and a pH of 7, it is less efficient than both enzymes 1 and 2.
  - D. Over the interval given, its optimal temperature at a pH of 7 is 10°C.
  - E. Over the interval given, its optimal pH at a temperature of 25°C is 4.
60. Which of the following statements can be made from review of these data?
- A. Enzyme 1 functions most efficiently in a basic environment and at a lower temperature.
  - B. All three enzymes function most efficiently above 20°C when the pH is held constant at 7.
  - C. Enzyme 1 functions more efficiently than enzyme 2 at 10°C and a pH of 7.
  - D. The pH does not affect the efficiency of enzyme 3.
  - E. All three enzymes function more efficiently in an acidic environment than a basic environment.